Species

23(71), 2022

A retrospective assessment of the diversity of Venomous and Non-venomous snakes in the Valsad region of Southern Gujarat

Maharshi Pandya[1*], Krutarth Raval[2], K Sasikumar[2], Sanjiv Tyagi[2], Deepak Rawtani[3]

To Cite:
Pandya M, Raval K, Sasikumar K, Tyagi S, Rawtani D. A retrospective assessment of the diversity of Venomous and Non-venomous snakes in the Valsad region of Southern Gujarat. *Species,* 2022, 23(71), 132-140

Author Affiliation:
[1]Snake Research Institute, Office of the Deputy Conservator of Forests, Valsad (North) Division, 1st Floor, Jilla Seva Sadan-2, Tithal Road, Valsad-396001, India
[2]Gujarat Forestry Research Foundation, J Road, Opposite Akshardham, Sector-30, Gandhinagar, Gujarat- 382030, India
[3]National Forensic Science University, Police Bhavan Rd, Sector 9, Gandhinagar, Gujarat 382007, India

***Corresponding author:**
Dr. Maharshi P. Pandya
Snake Research Institute, Office of the Deputy Conservator of Forests, Valsad (North) Division, 1st Floor, Jilla Seva Sadan-2, Tithal Road, Valsad-396001, India
Email: dr.maharshipandya@gmail.com

Peer-Review History
Received: 02 January 2022
Reviewed & Revised: 06/January/2022 to 12/March/2022
Accepted: 14 March 2022
Published: 16 March 2022

Peer-Review Model
External peer-review was done through double-blind method.

ABSTRACT

This study is about the diversity and distribution of venomous and non-venomous snakes in Dharampur taluka of Valsad District situated in South Gujarat. Dharampur located on the banks of the Dhamni River is known for its dense forest cover. The data collected from the rescue register maintained at Dharampur Range Office of the Gujarat Forest Department shows a total of twenty different snake species of six different families. From the total identified species, five species were venomous, two species were semi venomous and remaining were non-venomous. The *Colubridae* family dominate other families. Out of the six families identified, species belonging to *Colubridae* (33.58%) dominated, which was followed by *Elapidae* (32.09%), *Pythonidae* (22.12%), *Viperidae* (8.76%), *Boidae* (3.38%) and *Typhlopidae* (0.05%) respectively. Three species of snakes i.e., *Eryx conicus, Coelognathus helena, Ramphotyphlops braminus* assessed in this study are first reported occurrence in Gujarat. Since no earlier reports related to the diversity of venomous and non-venomous snakes of the Dharampur region are available, the study may serve as the baseline data for snakes from the Dharampur region of Gujarat.

Keywords: diversity and distribution; venomous and non-venomous snakes; snake species

1. INTRODUCTION

Species is the core of biology. As of December 2020, there are 3,889 known snake species worldwide, divided into 30 families and 531 genera. India alone is home to 310 snake species from 16 families (Uetz and Stylianou, 2018).

They make up about ten percent of all snake species on the planet, and eighty percent of them are non-poisonous (Kale et al., 2019). Out of only about 58 species of venomous snakes identified till date, only four are deadly to humans: *Naja naja, Daboia russelli, Bungarus caeruleus, Echis carinatus* (Jadhav et al., 2018; Khan et al., 2020).

Snakes are present in tropical and temperate environments, starting from oceans to mountain to oceans and upto deserts (Pauwels et al., 2008). In the terrestrial ecosystem, snakes play important roles in it as food web links, serve as predators, serve as bio-monitors in insect pest control, and ecological indicators as they are highly sensitive to even minor environmental changes (Koirala et al., 2016). Despite their importance in ecology and ethnozoology, venomous snakes, require attention from medical point of view because of their proclivity for retaliatory bites on humans and the resulting medical issues. It's crucial that people learn to identify dangerous snakes in the area. A majority of the people are unaware about the difference between venomous and non-venomous nature, which leads to man-animal conflict and as a result the existence of several snakes is threatened.

There have been reports by few researchers as described by Prabhakar et al., (2020). On snake diversity and distribution across India. Although many studies report diversity of snakes, yet apart from Patel and Vyas (2019) no other report highlights the diversity of snakes in the Gujarat State.

This study assesses the available data to document the variety, richness, and distribution of snakes including the venomous and nonvenomous snakes in Dharampur taluka of Valsad District.

2. MATERIALS AND METHODS

Study Site

Dharampur (Fig. 1) located at 20° 32' 24.5040'' N latitude and 73° 10' 45.1704'' E longitude is a remote neighbourhood of the Valsad district. It is a land of varied habitat from undulating hilly terrain to forest areas and man-made wetlands and agricultural lands and residential areas. Geographically, Dharampur is 726 km² in area, that includes 710.26 km² and 15.51 Km² of rural area and urban area respectively (https://villageinfo.in/gujarat/valsad/dharampur.html). The locals in the districts sustain their livelihood and generate their income from agricultural practices and rely on natural resources.

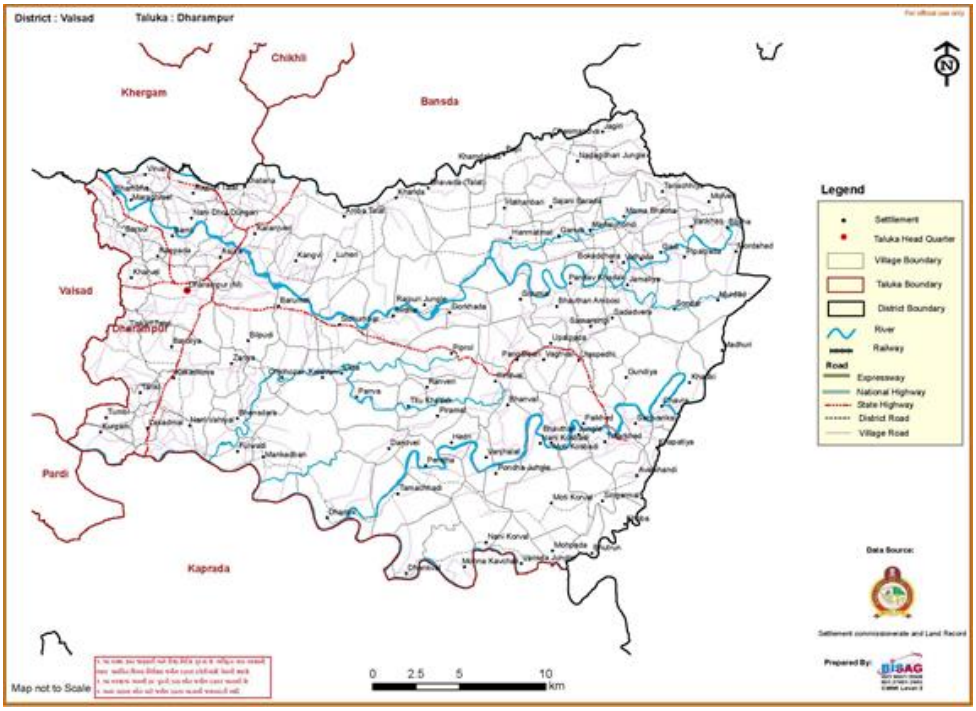

Figure 1. Map of Dharampur (Study area)

Identification of snakes

Individuals/Volunteers/Rescuers well versed in morphological identification of snakes, working in association with the forest department receive a call from locals/residents when snakes are sighted in their houses or in and around their areas. Snakes were rescued using tools like a snake hook, snake bag and torch. No incidence of snakebite among rescuers has been recorded. After rescuing, the details of place of rescue and type of snake rescued were recorded before release. The release was done in the presence of the official of the Forest Department within the 5 Km of the site of snake capture. The book titled Snakes of India- the field guide authored by Romulus Whitaker & Ashok Captain was used as a reference for identification of snakes as and when required.

ISSN 2319–5746 EISSN 2319–5754 I OPEN ACCESS

3. RESULTS AND DISCUSSION

Diversity

This study highlights the diversity of snakes in the Dharampur region of Gujarat State (**Fig. 1).** A total of 20 species belonging to 6 different families were recorded from different parts of Dharampur. Of the twenty species identified, two species belonged to the *Boidae* family, eleven to the *Colubridae* family, three to the *Elapidae* family, two to the *Viperidae* family and one species each to *Pythonodae* & *Typhlopidae* family respectively **(Table 1) (Fig. 2)**. Out of twenty species identified, 5 were venomous, two semi venomous and thirteen were non-venomous snakes.

Table 1. List of snake species observed in Dharampur during September 2019- September 2021

S. no	Family	Common name	Scientific name	Number of snakes rescued	venomous/ non-venomous	Site of capture/ Town	IUCN STATUS
1.	***Boidae*, (Gray,1825)**	Red Sand Boa	*Eryx johnii*	58	Non-venomous	Dharampur	**NT***
2.	***Boidae*, (Gray,1825)**	Common Sand Boa	*Gongylophis conicus*/ *Eryx conicus*	1	Non-venomous	Dharampur	**1st Report NT*$**
3.	***Colubridae* (Oppel,1811)**	Indian rat snake	*Ptyas mucosa*	407	Non-venomous	Dharampur	**LC#**
4.	***Colubridae* (Oppel,1811)**	Checkered keelback	*Xenochrophis piscator*	84	Non venomous	Dharampur	**LC#**
5.	***Colubridae* (Oppel,1811)**	Common Wolf snake	*Lycodon aulicus*	48	Non-venomous	Dharampur	**LC#**
6.	***Colubridae* (Oppel,1811)**	Common Kukri snake	*Oligodon arnensis*	14	Non-venomous	Dharampur	**LC#**
7.	***Colubridae* (Oppel,1811)**	Stripped keelback	*Amphiesma stolatum*	13	Non-venomous	Dharampur	**LC#**
8.	***Colubridae* (Oppel,1811)**	Common vine snake	*Ahaetulla nasuta*	8	Mildly Venomous	Dharampur	**LC#**
9.	***Colubridae* (Oppel,1811)**	Banded racer	*Argyrogena fasciolata*	5	Non-venomous	Dharampur	**LC#**
10.	***Colubridae* (Oppel,1811)**	Common cat snake	*Boiga trigonata trigonata*	5	Mildly Venomous	Dharampur	**LC#**
11.	***Colubridae* (Oppel,1811)**	Green Keelback	*Macropisthodon plumbicolor* ()	1	Non venomous	Dharampur	**LC#**
12.	***Colubridae* (Oppel,1811)**	Common Bronzeback Tree Snake	*Dendrelaphis tristis*	1	Non-venomous	Dharampur	**LC#**
13.	***Colubridae* (Oppel,1811)**	Common Trinket snake	*Coelognathus helena*	149	Non-venomous	Dharampur	**1st Report LC$**
14.	***Elapidae* (Boie, 1827)**	Common krait	*Bungarus caerulues* (Schneider, 1801)	48	Venomous	Dharampur	**LC#**
15.	***Elapidae* (Boie, 1827)**	Cobra	*Naja naja* (Linnaeus, 1758)	510	Venomous	Dharampur	**LC#**
16.	***Elapidae* (Boie, 1827)**	Slender coral snake	*Calliophis melanurus*	2	Venomous	Dharampur	**LC#**
17.	***Pythonidae*, (Fitzinger,1826)**	Indian Rock Python	*Python molurus molurus*	237	Non-venomous	Dharampur	**NT**
18.	***Typhlopidae* (Merrem, 1820)**	Common worm snake	*Ramphotyphlops braminus*	1	Non-venomous	Dharampur	**1st Report LC$**
19.	***Viperidae* (Boie, 1827)**	Indian Russell's viper	*Daboia russelii russelii* (Shaw & Nodder, 1797)	148	Venomous	Dharampur	**LC**
20.	***Viperidae* (Boie, 1827)**	Saw scaled viper	*Echis carinatus* (Schneider, 1801)	**5**	Venomous	Dharampur	**LC**

*NT= Near Threatened; #LC= Least Concerned; $ = First report from Gujarat

ISSN 2319–5746 EISSN 2319–5754 I OPEN ACCESS

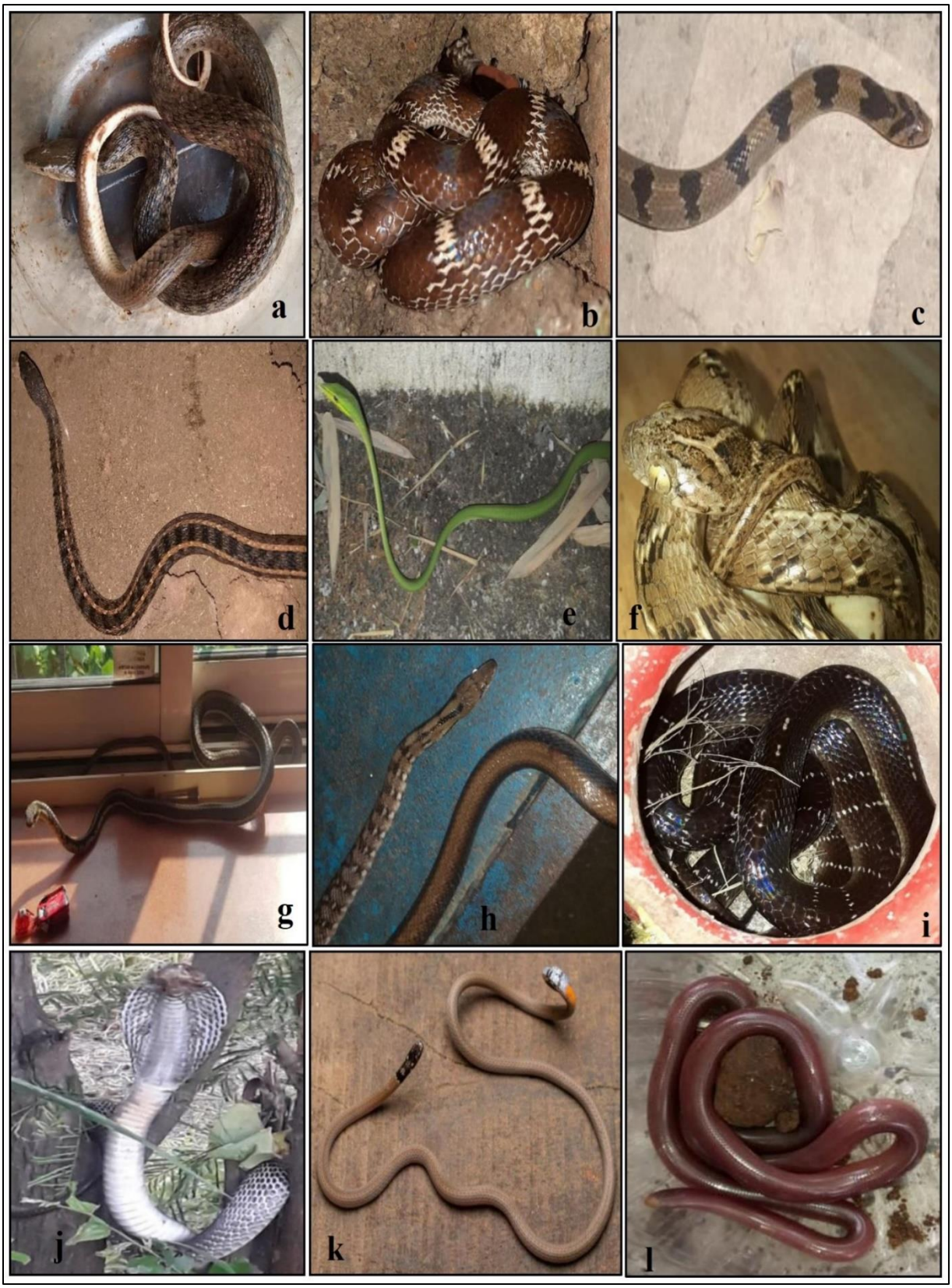

Figure 2. Images of Snake diversity [a - Checkered keelback (*Xenochrophis piscator*), **b** - Common Wolf snake (*Lycodon aulicus*), **c** - Common Kukri snake (*Oligodon arnensis*), **d** - Stripped keelback (*Amphiesma stolatum*), **e** - Common vine snake (*Ahaetulla nasuta*), **f** - Common cat snake (*Boiga trigonata trigonata*), **g** - Common Bronzeback Tree Snake (*Dendrelaphis tristis*), **h** - Common Trinket snake (*Coelognathus helena*), **i** - Common krait (*Bungarus caerulues*), **j** - Cobra (*Naja naja*), **k** - Slender coral snake (*Calliophis melanurus*), **l** - Common worm snake (*Ramphotyphlops braminus*)]

ISSN 2319–5746 EISSN 2319–5754 I OPEN ACCESS

A period from September (2019) to August (2021) was taken into consideration to identify the different snake species in the Dharampur region. The family *Colubridae* was the most diverse in terms of abundance (**Fig.3**), species richness (**Fig.4**) and generic richness. It accounted for 11 genera and 11 species followed by *Elapidae* (three genera, three species). The third most speciose families include *Boidae* (two genera, two species), *Pythonidae* (1 species), followed by *Viperidae* (two genera, 2 species). *Typhlopidae* was found to be the least diverse family, represented by one genus with a single species. The observations in this study were in agreement with other studies conducted across India and abroad which state that species of the *Colubridae* family are predominant, followed by other families (Lalremsanga et al., 2018, Prabhakar et al., 2020, Koirala et al., 2021).

Out of the total recorded species, five species were identified as venomous. These include the BIG-4 medically important snakes viz., Indian Cobra (*Naja naja*), Common Krait (*Bungarus caerulus*), Saw scaled viper (*Echic carinatus*), Russell's viper (*Daboia russelli*) and Slender coral snake (*Calliophis melanurus*). Two species of *Colubridae* family viz., Common vine snake (*Ahaetulla nasuta*) and Common cat snake (*Boiga trigonata trigonata*) were mildly venomous and remaining were non-venomous snake species. Out of the BIG-4 medically important venomous snakes, Indian cobra was rescued the most (510 times) followed by Russell's viper which was rescued 148 times, followed by Common krait and Saw-scaled viper which were rescued 48 and 5 times respectively.

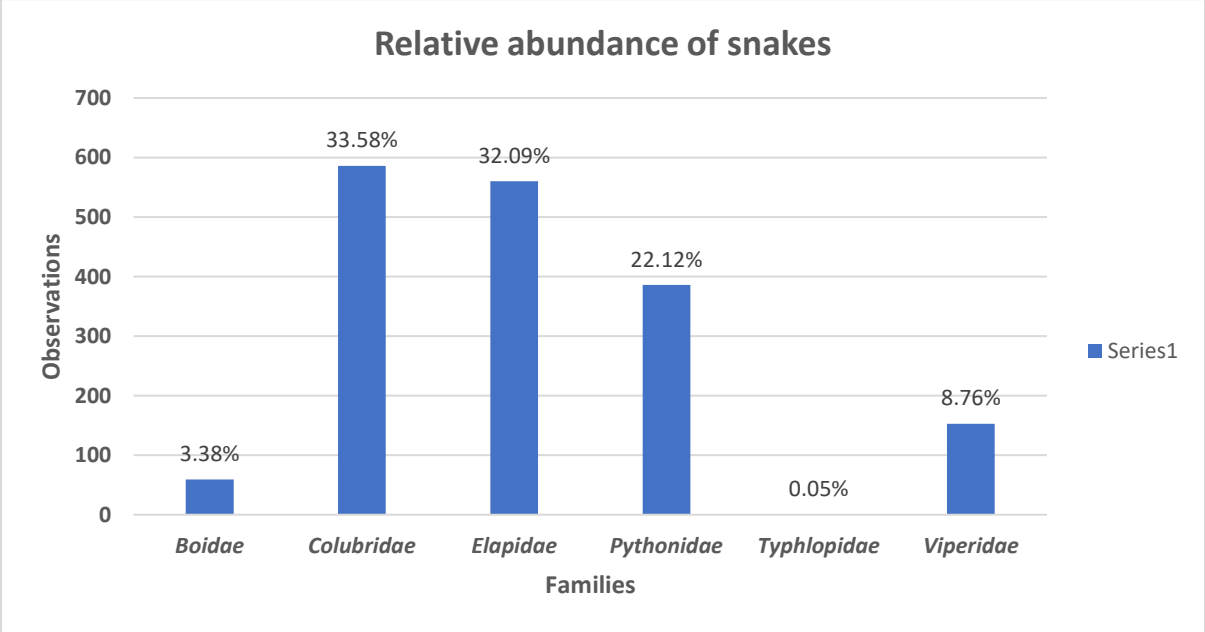

Figure 3. Relative abundance of snakes with respect to families in Dharampur.

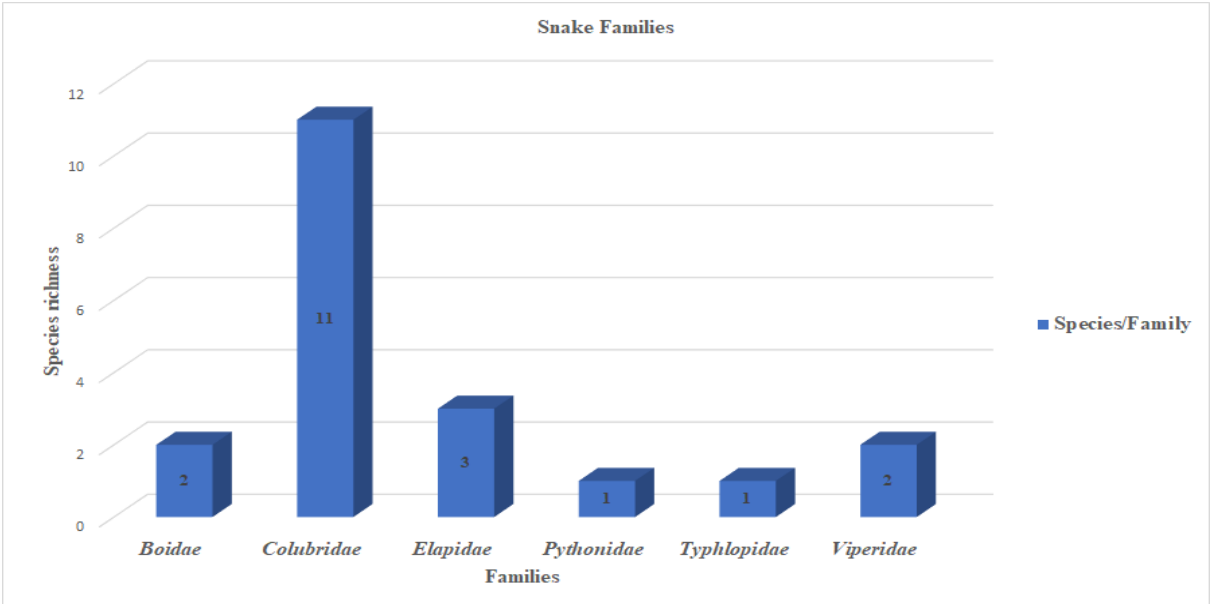

Figure 4. Species richness of snakes with respect to snake families

ISSN 2319–5746 EISSN 2319–5754 I OPEN ACCESS

In total, 1745 safe snake rescues were performed in the study period. Relative abundance data indicated that the snakes belonging to the *Colubridae* family were the most common (n= 586, 33.58%), followed by *Elapidae* (n=560, 32.09%), *Pythonidae* (n=386, 22.12%), *Viperidae* (n=153, 8.76%), *Boidae* (n=59, 3.38%), and species belonging to *Typhlopidae* were observed least (n=1, 0.05%) of the total individuals recorded (**Fig. 3**). Colubrids were the most dominant in the data because of their high richness and comprised 50% of the total species recorded (Fig.3).

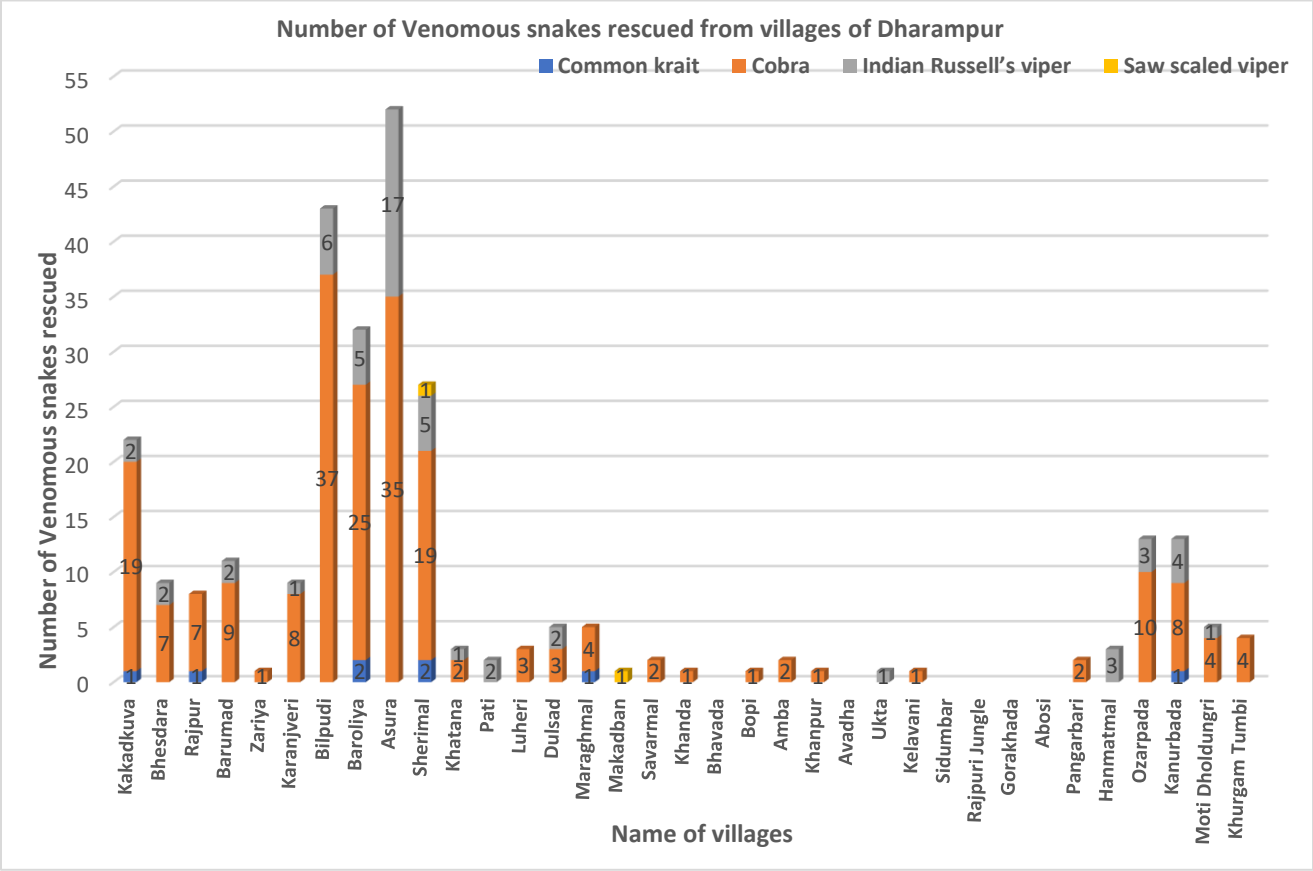

Figure 5. Number of venomous snakes rescued from villages of Dharampur

The snakes, reported in this study, were rescued from the 35 villages in Dharampur. Out of these 35 villages, medically important BIG-4 snakes were rescued from 29 villages. Of these 29 villages, seven villages viz., Bilpudi, Asura, Baroliya, Kakadkuva, Sherimal, Ozarpada and Kanurbada accounted for 85% of the total rescued Cobra. Out of 57 Indian Russells viper rescued, 57% were rescued from Bilipudi, Baroliya, Asura, Sherimal, Ozarpada and Kanurbada **(Fig. 4)**. It can be evident from (**Fig. 5)**, during the study period, Bilpudi, Asura, Baroliya, and Sherimal harboured the highest population of Cobra and Russell's viper compared to other villages listed in the study.

ISSN 2319–5746 EISSN 2319–5754 I OPEN ACCESS

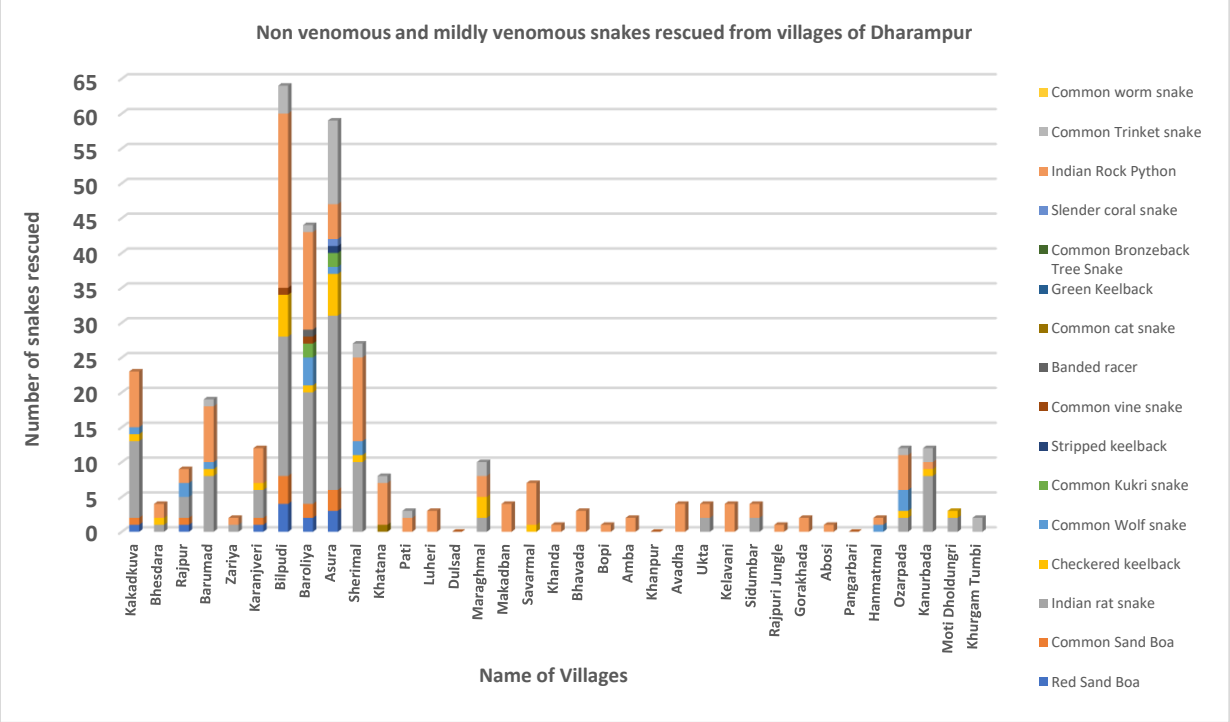

Figure 6. Number of non-venomous and mildly venomous snakes rescued from villages of Dharampur

Among the non-venomous and mildly venomous snakes rescued during the study period, Kakadkuva, Bilipudi, Baroliya, Asura, and Sherimal accounted for 60.9% of snakes (**Fig. 6**).

Out of the total non-venomous and mildly venomous snakes, the highest rescued snake species was the Indian Rock python which accounted for 38.2%, followed by the Indian Rat snake which accounted for 32.8% of the total population. This was followed by Common trinket snake and Checkered keelback with 8.1% and 7.02% respectively.

New records for the state

From the present study, three species of snakes *Eryx conicus* (Family:*Boidae*), *Coelognathus helena* (Family:*Pythonidae*) and *Ramphotyphlops braminus* (Family: *Typhlopidae*) identified in Dharampur, are new additions to the exhaustive list of the diversity of reptiles in Gujarat, reported by Patel and Vyas (2019). This provides new information on the extension range of the above species in their distribution. However, the IUCN status of three species viz., *Python molorus*, *Eryx johnii* and *Eryx conicus* that belonged to least concern (LC) category in 2018, has now changed to nearly threatened (NT) category which is alarming and demands earnest attention towards the protection of these serpents.

A comparative account of the diversity of snake families reported in previous studies conducted across India has been tabulated (**Table 2**).

Table 2. Studies reporting snake diversity across India

S. No.	Study Area	State	Reported by	Number of families reported	Name of families
1.	Chennai	Tamil Nadu	Janani et al., 2016	5	*Boidae, Colubridae, Elapidae, Typhlopidae, Viperidae*
2.	Gandhamardan hills range	Orissa	Pradhan et al., 2014	5	*Boidae, Colubridae, Elapidae, Viperidae, Typhlopidae*
3.	Palghar	Maharashtra	Raut et al., 2014	5	*Boidae, Colubridae, Elapidae, Viperade, Typhlopidae*
4.	Nanded city	Maharashtra	Jadhav et. al., 2018	5	*Boidae, Colubridae, Elapidae, Viperidae, Pythonidae*

ISSN 2319–5746 EISSN 2319–5754 I OPEN ACCESS

5.	Shivaji University Campus, Kolhapur	Maharashtra	Yadav et al., 2014	6	*Boidae, Colubridae, Typhlopidae, Uropeltidae, Elapidae, Viperidae*
6.	Mokhada and Jawhar	Maharashtra	Bansode et al., 2016	7	*Boidae, Colubridae, Elapidae, Typhlopidae, Uropeltidae, Viperidae, Lamprophiidae*
7.	Panvel	Maharashtra	Prabhakar et al., 2020	10	*Colubridae, Erycidae, Homalopsidae, Lamprophiidae, Natricidae, Pythonidae, Sibynophiidae, Typhlopidae, Elapidae, Viperidae*
8.	Pachmarhi Biosphere Reserve	Madhya Pradesh	Fellows S. (2014)	6	*Boidae, Colubridae, Elapidae, Typhlopidae, Uropeltidae, Viperidae*
9.	Shankaraghatta, Shivamogga	Karnataka	Phashi & Kumara, 2021	7	*Boidae, Colubridae, Elapidae, Pythonidae, Typhlopidae, Uropeltidae, Viperidae*

The observations recorded in this study highlight the fact that six families of snakes are present in Dharampur which is higher than families reported in studies conducted in Palghar (Raut et al., 2014), Gandhamardan hills located in the Orissa State (Pradhan et al., 2014), Nanded city (Jadhav et al., 2018), Mizoram (Lalremsanga et al., 2018), Chennai, Tamil Nadu (Janani et al., 2016) and lower than the diversity reported in Shivaji University Campus (Yadav et al., 2014), Pachmarhi Biosphere Reserve (Fellows, 2014), Mokhada and Jawahar (Bansode et al., 2016), Shankarghatta (Phashi and Kumara, 2021) and in Panvel (Prabhakar et al., 2020). The higher diversity in Panvel may be because of its location. It is sited on the Panvel Creek and is surrounded by mountains on two sides, which may lead to favourable conditions for housing diversity of snakes due to different habitat options.

It is noteworthy that Dharampur, spanning an area of mere 726 km² (including 710.26 km² rural area and 15.51 km² urban area) houses more families of snakes compared to snake families in the Tashigang Territorial Forest Division in Bhutan, which spans an area of 2447.40 Km² (Koirala et al., 2021). Overall, the data suggest that species richness and diversity is relatively high and that small, geographical regions like Dharampur with plantation and forest area can house a diverse group of snake species. Taking into account, the limited research articles on the, distribution and natural history of serpents of the region, this study has the potential to serve as the baseline for future studies. Additional comprehensive surveys and extensive research in economically vulnerable areas containing high biodiversity to facilitate snake monitoring efforts, assess the threat to snakes and foresee potential threats to vulnerable snake species is recommended. Furthermore, considering the abundance of snakes in Dharampur, it is advisable to bring awareness among locals, students and people residing in nearby areas about the venomous and non-venomous snakes to prevent human-caused mortality of snakes due to fear or by a road accident.

The results in this study are based on the entries maintained by the experienced volunteers and rescuers working in congregation with the Forest Department of Gujarat State, which enlists the details of the snakes rescued in the presence of the local wildlife warden. Thus, this study may not represent actual diversity as there may be still some potential unexplored areas. However, this assessment has the potential to serve as a foundation for further studies in this and other regions. Furthermore, it is also emphasized that a holistic, education-centric conservation strategy combined with ecological research should be undertaken to mitigate the snake human conflict in the area.

Acknowledgement:
Authors are grateful to Chairman, Snake Research Institute, Shri S. Maniswara Raja; Vice-Chairman, Dr. Dhirubhai C. Patel; Director, Snake Research Institute, Shri. Yuvrajsinh Jhala for their motivation and valuable comments and suggestions. Thanks, are also due to Forester, Mr. Shaktisinh Chavda for his active role in snake rescue and release. Thanks are also due to skilful snake rescuer and photographer Mr. Vipul Patel for his service in snake rescue, release and documentation in coordination with the forest department. The authors are also grateful to the forest officers of Dharampur Range for their sincere efforts in proper rescue of snakes. Authors are indebted to the Forests & Environment Department.

Authors' contributions:
Maharshi Pandya: Collected the data, performed the analysis, wrote the paper

Krutarth Raval: Formatting of manuscript, organizing tables and images
K Sasikumar: Proofreading
Sanjiv Tyagi: Performed the analysis and Proofreading
Deepak Rawtani: Proofreading

Ethical approval

Three species of snakes i.e., *Eryx conicus*, *Coelognathus helena*, *Ramphotyphlops braminus* are assessed in this study from Gujarat. The book titled Snakes of India- the field guide authored by Romulus Whitaker & Ashok Captain was used as a reference for identification of snakes. The ANIMAL ethical guidelines are followed in the study for the observation of Species.

Funding: This study has not received any external funding.

Conflicts of interests: The authors declare that there are no conflicts of interests.

Data and materials availability

All data associated with this study are present in the paper.

REFERENCES AND NOTES

1. Bansode SA, More VR, Mirza KA. A study on snakes from Mokhada and Jawhar (Dist. Palghar) Maharashtra, India. International journal of fauna and biological studies. 2016: 3: 5: 103-115.
2. Fellows S. Species diversity of snakes in Pachmarhi Biosphere Reserve. Entomol Ornithol Herpetol. 2015: 4: 136: 2161-0983.
3. Jadhav PL, Chavan SP, Trimukhe HS. Snake species diversity and their distribution in and around Nanded city, Maharashtra, India. Journal of Entomology and Zoology Studies. 2018: 6: 4: 1855-1860.
4. Janani S, Maheshwaran EG, Leenu J, Samuel T, Raveen R. Diversity of snakes rescued at Chennai, Tamil Nadu, India. International Journal of Fauna and Biological Studies. 2016;3(5):81-6.
5. Khan KI, Ghule A, Kumar S. Dry Bite by Common krait: A rare phenomenon & its management; rationale use of antivenom. Med Sci 2020;24(104):2418-2423
6. Koirala BK, Gurung DB, Lhendup P, Phuntsho S. Species diversity and spatial distribution of snakes in Jigme Dorji National Park and adjoining areas, western Bhutan. Journal of Threatened Taxa. 2016;8(12):9461-6.
7. Koirala BK, Jamtsho K, Wangdi P, Tshering D, Wangdi R, Norbu L, Phuntsho S, Lhendup S, Nidup T, Sreenivasan N, Mahesh N. Diversity and distribution of snakes in Trashigang Territorial Forest Division, eastern Bhutan. Journal of Threatened Taxa. 2021;13(1):17455-69.
8. Lalremsanga HT, Sailo S, Hauzel C (2018) Diversity of Snakes (Reptilia: Squamata) and Role of Environmental Factors in Their Distribution in Mizoram, Northeast India. 2018.
9. Patel H, Vyas R. Reptiles of Gujarat, India: updated checklist, distribution, and conservation status. Herpetology Notes. 2019;12:765-77.
10. Pauwels OS, Wallach V, David P. Global diversity of snakes (Serpentes; Reptilia) in freshwater. InFreshwater Animal Diversity Assessment. Springer, Dordrecht. 2007: 599-605.
11. Pawar Prabhakar R, Rokade Anil G, Supnekar Santosh P, Meshram Leena N, Pawar Namdeo B, Gavhane Usha V. Diversity and distribution of snakes in adjoining areas of Panvel, Navi Mumbai, West Coast of India. International Journal of Zoological Investigations. 2020: 6: 2: 289-300.
12. Phashi DK, Kumara V. A Preliminary Survey on Snake Diversity and Status in and around Villages of Shankaraghatta, Shivamogga, Karnataka, India. Journal of Academia and Industrial Research. 2021;9(3):56-60.
13. Pradhan S, Mishra D, Sahu KR. An inventory and assessment of snake diversity of Gandhamardan hills range of western Orissa, India. International Journal of Pure and applied zoology. 2014: 2: 3: 241-5.
14. Raut SR, Deshbhratar SM, Mahaley JA, Hile VK, Singh AJ, Mehta GU. Recent studies on the biodiversity of snakes in Palghar region, Thane, Maharashtra, India. Advances in Applied Science Research. 2014: 5 :2: 373-381.
15. Romulus W, Captain A. Snakes of India: The Field Guide. 2004.
16. Uetz P, Stylianou A. The original descriptions of reptiles and their subspecies. Zootaxa. 2018;4375(2):257-64.
17. Yadav OV, Yankanchi SR, Patil AM. Diversity, threats and conservation of herpetofauna in Shivaji University Campus, Kolhapur, Maharashtra, India. Int. J. Curr. Microbiol. Appl. Sci. 2014: 3: 6: 742-749.

ISSN 2319–5746 EISSN 2319–5754 I OPEN ACCESS